

Amendments to the Claims

1. **(Currently Amended)** An OFDM demodulation apparatus for demodulating an OFDM signal which includes a specific synchronous symbol and an OFDM data symbol structured by a valid symbol period and a guard interval, said apparatus comprising:

an impulse response estimation part for estimating an impulse response from ~~said~~ the OFDM signal based on the synchronous symbol;

an integration part for integrating an output obtained by estimation in said impulse response estimation part;

a determination part for detecting symbol timing indicating a period where ~~said~~ an output obtained by integration in said integration part is maximum;

a window timing generation part for generating, according to ~~said~~ the symbol timing, window timing including information which is capable of providing ~~said~~ the valid symbol period; and

a Fourier transformation part for subjecting ~~said~~ the OFDM signal to Fourier transform according to ~~said~~ the window timing.

2. **(Withdrawn - Currently Amended)** The OFDM demodulation apparatus according to claim 1, when an identical waveform is periodically transmitted in ~~said~~ the synchronous symbol ~~for~~ at least twice ~~or more~~, said apparatus further comprising:

a delay part for delaying ~~said~~ the OFDM signal for a predetermined number of samplings;

a multiplication part for multiplying a signal obtained by delay in said delay part and ~~said~~ the OFDM signal;

an averaging part for averaging a signal obtained by multiplication in said multiplication part;

a frequency error calculation part for calculating a frequency error based on a signal obtained by averaging in said averaging part;

a hold part for holding ~~said~~ the frequency error according to ~~said~~ the symbol timing; and

a frequency correction part for correcting a frequency shift of ~~said the~~ OFDM signal according to ~~said the~~ frequency error provided by said hold part, wherein said Fourier transformation part subjects, to Fourier transform, ~~said the~~ OFDM signal with frequency shift corrected by said frequency correction part according to ~~said the~~ window timing.

3. **(Withdrawn - Currently Amended)** The OFDM demodulation apparatus according to claim 1, when an identical waveform is periodically transmitted in ~~said the~~ synchronous symbol ~~for at least twice or more, the said~~ apparatus further comprising:

a first delay part for delaying ~~said the~~ OFDM signal, ~~as a (hereinafter, first OFDM signal),~~ for a first predetermined number of samplings;

a first multiplication part for multiplying a signal obtained by delay in said first delay part and ~~said the~~ first OFDM signal;

a first averaging part for averaging a signal obtained by multiplication in said first multiplication part;

a first frequency error calculation part for calculating a first frequency error based on a signal obtained by averaging in said first averaging part;

a filter part for smoothing a signal obtained by multiplication in said first multiplication part;

an absolute value calculation part for calculating an absolute value of a signal obtained by smoothing in said filter part;

a first determination part for determining, according to ~~said the~~ absolute value, a correlation between ~~said the~~ first OFDM signal and the signal obtained by delay in said first delay part, and detecting symbol timing of ~~said the~~ first OFDM signal;

a first hold part for holding ~~said the~~ first frequency error according to ~~said the~~ symbol timing detected by said first determination part;

a first frequency correction part for correcting a frequency shift of ~~said the~~ first OFDM signal according to ~~said the~~ first frequency error provided by said first hold part;

a second delay part for delaying, for a second predetermined number of samplings, ~~said the~~ first OFDM signal, as a second OFDM signal, with frequency shift corrected by ~~the said~~ first frequency correction part ~~(hereinafter, second OFDM signal);~~

a second multiplication part for multiplying a signal obtained by delay in said second delay part and ~~said the~~ second OFDM signal;

a second averaging part for averaging a signal obtained by multiplication in said second multiplication part;

a second frequency error calculation part for calculating a second frequency error based on a signal obtained by averaging in said second averaging part;

a second hold part for holding ~~said the~~ second frequency error according to ~~said the~~ symbol timing detected by said determination part; and

a second frequency correction part for correcting a frequency error of ~~said the~~ second OFDM signal according to ~~said the~~ second frequency error provided by said second hold part, wherein

said impulse response estimation part estimates the impulse response from ~~said the~~ second OFDM signal, and

said Fourier transformation part subjects, to Fourier transform, ~~said the~~ second OFDM signal with frequency shift corrected by said second frequency conversion part according to ~~said the~~ window timing.

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4. (Currently Amended) The OFDM demodulation apparatus according to claim 1, wherein said integration part regards a time length of ~~said the~~ guard interval as an integration section, and integrates an incoming signal while sequentially shifting ~~the~~ a location of the integration section with respect to the incoming signal.

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5. (Currently Amended) The OFDM demodulation apparatus according to claim 1, wherein said integration part regards a time length of ~~said the~~ guard interval and a predetermined time length before and after the guard interval as an integration section, and by integrating an incoming signal while sequentially shifting ~~the~~ a location of the integration section with respect to the incoming signal, responds before and after a rectangular impulse response in the time length of ~~said the~~ guard interval.

7. (Currently Amended) The OFDM demodulation apparatus according to claim 1, wherein said integration part regards a time length of ~~said the~~ guard interval and a predetermined time length before and after the guard interval as an integration section, and by integrating an incoming signal while sequentially shifting ~~the~~ a location of the integration section with respect to the incoming signal, responds ~~monotonously increasing with a monotonous increase~~ before a rectangular impulse response in the time length of ~~said the~~ guard interval ~~but monotonously decreasing thereafter and a monotonous decrease after the rectangular impulse response.~~

8. (Currently Amended) The OFDM demodulation apparatus according to claim 1, wherein said impulse response estimation part comprises:

a synchronous symbol generation part for generating a signal identical to ~~said the~~ synchronous symbol;

a correlation part for calculating a signal indicating how the signal generated by said synchronous symbol generation part and ~~said the~~ OFDM signal are correlated to each other; and

a correlation calculation part for calculating a correlation from the signal obtained by calculation in said correlation part.

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8. (Currently Amended) The OFDM demodulation apparatus according to claim 1, wherein said impulse response estimation part comprises:

a synchronous symbol generation part for generating a signal whose frequency domain is identical to ~~said the~~ synchronous symbol;

a multiplication part for multiplying a signal provided by said Fourier transformation part and the signal provided by said synchronous symbol generation part;

an inverse Fourier transformation part for subjecting, to inverse Fourier transform, a signal obtained by multiplication in said multiplication part; and

a correlation calculation part for calculating a correlation from a signal provided by said inverse Fourier transformation part.

9. **(Currently Amended)** The OFDM demodulation apparatus according to claim ⁸~~7~~,
wherein

said correlation calculation part calculates an absolute value of a complex vector
(i, q) of the incoming signal.

¹³~~10~~. **(Currently Amended)** The OFDM demodulation apparatus according to claim ¹²~~8~~,
wherein

said correlation calculation part calculates an absolute value of a complex vector
(i, q) of the incoming signal.

¹⁰~~11~~. **(Currently Amended)** The OFDM demodulation apparatus according to claim ⁸~~7~~,
wherein

said correlation calculation part calculates a sum of an absolute value of i and an
absolute value of q from ~~the~~ a complex vector (i, q) of the incoming signal.

¹⁴~~12~~. **(Currently Amended)** The OFDM demodulation apparatus according to claim ¹²~~8~~,
wherein

said correlation calculation part calculates a sum of an absolute value of i and an
absolute value of q from ~~the~~ a complex vector (i, q) of the incoming signal.

¹¹~~13~~. **(Currently Amended)** The OFDM demodulation apparatus according to claim ⁸~~7~~,
wherein

said correlation calculation part calculates a sum of a square of i and a square of q
from ~~the~~ a complex vector (i, q) of the incoming signal.

¹⁵~~14~~. **(Currently Amended)** The OFDM demodulation apparatus according to claim ¹²~~8~~,
wherein

said correlation calculation part calculates a sum of a square of i and a square of q
from ~~the~~ a complex vector (i, q) of the incoming signal.

⁴
15. (Withdrawn - Currently Amended) The OFDM demodulation apparatus according to claim 3, wherein
said first determination part receives ~~said~~ the absolute value calculated by said absolute value calculation part, detects a value for invariability thereof, and then detects the absolute value showing a predetermined proportion to the invariable value.

[Claims 16-21 (Canceled)]

¹⁶
21. (Currently Amended) An OFDM demodulation method for demodulating an OFDM signal which includes a specific synchronous symbol and an OFDM data symbol structured by a valid symbol period and a guard interval, said method comprising:

an impulse response estimation ~~step~~ operation of estimating an impulse response from ~~said~~ the OFDM signal based on the synchronous symbol;

an integration ~~step~~ operation of integrating an output obtained by estimation in said impulse response estimation ~~step~~ operation;

a determining ~~step~~ operation of detecting symbol timing indicating a period where said an output obtained by integration in said integration ~~step~~ operation is maximum;

a window timing generation ~~step~~ operation of generating, according to ~~said~~ the symbol timing, window timing including information which is capable of providing ~~said~~ the valid symbol period; and

a Fourier transformation ~~step~~ operation of subjecting ~~said~~ the OFDM signal to Fourier transform according to ~~said~~ the window timing.

¹⁷
23. (Withdrawn - Currently Amended) The OFDM demodulation method according to claim ¹⁶22, when an identical waveform is periodically transmitted in ~~said~~ the synchronous symbol ~~for at least twice or more, the said~~ method further comprising ~~the~~ steps of:

delaying ~~said~~ the OFDM signal for a predetermined number of samplings;

multiplying a signal obtained by delay in said ~~delay part~~ delaying operation and ~~said~~ the OFDM signal;

averaging a signal obtained by multiplication in ~~said multiplication part~~
multiplying operation;

calculating a frequency error based on a signal obtained by averaging in ~~said~~
averaging part operation;

holding ~~said the~~ frequency error according to ~~said the~~ symbol timing; and

correcting a frequency shift of ~~said the~~ OFDM signal according to ~~said the~~
frequency error provided in ~~said holding-step operation~~, wherein in ~~said Fourier-~~
~~transform-step operation~~, ~~said the~~ OFDM signal with frequency shift corrected is
subjected to Fourier transform according to ~~said the~~ window timing.

¹⁸
24. (Withdrawn - Currently Amended) The OFDM demodulation method according
to claim ¹⁶22, when an identical waveform is periodically transmitted in ~~said the~~
synchronous symbol ~~for at least twice or more, the said~~ method further comprising:

a first ~~delay-step operation~~ of delaying ~~said the~~ OFDM signal, ~~as a (hereinafter,~~
first OFDM signal), for a first predetermined number of samplings;

a first ~~multiplication-step operation~~ of multiplying a signal obtained by delay in
said first ~~delay-step operation~~ and ~~said the~~ first OFDM signal;

a first ~~averaging-step operation~~ of averaging a signal obtained by multiplication in
said first ~~multiplication-step operation~~;

a ~~step~~ first frequency error calculating operation of calculating a first frequency
error based on a signal obtained by averaging in said first ~~averaging-step operation~~;

a ~~step of~~ smoothing a signal obtained by multiplication in said first ~~multiplication~~
~~step operation~~;

a ~~step of~~ calculating an absolute value of a signal obtained by smoothing in
~~smoothing-step operation~~;

a first ~~determination-step operation~~ of determining, according to ~~said the~~ absolute
value, a correlation between ~~said the~~ first OFDM signal and the signal obtained by delay
in said first ~~delay-step operation~~, and detecting symbol timing of ~~said the~~ first OFDM
signal;

a ~~step~~ first holding operation of holding ~~said the~~ first frequency error according to
~~said the~~ symbol timing detected in said first ~~determination-step operation~~;

a ~~step~~ first frequency correction operation of correcting a frequency shift of ~~said~~ the first OFDM signal according to ~~said~~ the first frequency error held;

a second ~~delay-step~~ operation of delaying, for a second predetermined number of samplings, ~~said~~ the first OFDM signal, as a second OFDM signal, with frequency shift corrected (~~hereinafter, second OFDM signal~~);

a second ~~multiplication-step~~ operation of multiplying a signal obtained by delay in said second ~~delay-step~~ operation and ~~said~~ the second OFDM signal;

a second ~~averaging-step~~ operation of averaging a signal obtained by multiplication in said second ~~multiplication-step~~ operation;

a ~~step~~ second frequency error calculating operation of calculating a second frequency error based on a signal obtained by averaging in said second ~~averaging-step~~ operation;

a ~~step~~ second holding operation of holding ~~said~~ the second frequency error according to ~~said~~ the symbol timing detected in said ~~determination-step~~ operation; and

a ~~step~~ second frequency correction operation of correcting a frequency shift of ~~said~~ the second OFDM signal according to ~~said~~ the second frequency error held,

wherein in said ~~estimating-step~~ operation, an impulse response is estimated from ~~said~~ the second OFDM signal, and

in said ~~Fourier-transform-step~~ operation, according to ~~said~~ the window timing, ~~said~~ the second OFDM signal with frequency shift corrected is subjected to Fourier transform.

²⁰
~~25~~. (Currently Amended) The OFDM demodulation method according to claim ¹⁶~~22~~, wherein in said ~~integrating-step~~ operation, a time length of ~~said~~ the guard interval is ~~regard~~ regarded as an integration section, and an incoming signal is integrated while ~~the~~ a location of the integration section ~~being~~ is sequentially shifted with respect to the incoming signal.

²¹
~~26~~. (Currently Amended) The OFDM demodulation method according to claim ¹⁶~~22~~, wherein in said ~~integrating-step~~ operation, a time length of ~~said~~ the guard interval and a predetermined time length before and after the guard interval are regarded as an

integration section, and by integrating an incoming signal while sequentially shifting the a location of the integration section with respect to the incoming signal, a response is provided before and after a rectangular impulse response having the time length of said the guard interval.

²²
27. (Currently Amended) The OFDM demodulation method according to claim ¹⁶22, wherein in said ~~integrating-step operation~~, a time length of ~~said the~~ guard interval and a predetermined time length before and after the guard interval are regarded as an integration section, and by integrating an incoming signal while sequentially shifting the a location of the integration section with respect to the incoming signal, a response which monotonously ~~increasing~~ increases before a rectangular impulse response having the time length of ~~said the~~ guard interval ~~but and~~ monotonously ~~decreasing thereafter~~ decreases after the rectangular response is provided.

²³
28. (Currently Amended) The OFDM demodulation method according to claim ¹⁶22, wherein said ~~estimating-step~~ impulse response estimation operation comprises the steps of:

generating a signal identical to ~~said the~~ synchronous symbol;
calculating a signal indicating a correlation between a signal generated in said ~~generating-step operation~~ and ~~said the~~ OFDM signal; and
calculating a correlation from ~~a the~~ signal obtained in said ~~calculating-step operation~~.

²⁷
29. (Currently Amended) The OFDM demodulation method according to claim ¹⁶22, wherein said ~~estimating-step~~ impulse response estimation operation comprises the steps of:

generating a frequency-domain signal identical to ~~said the~~ synchronous symbol;
multiplying a signal obtained in said ~~Fourier-transform-step operation~~ and the frequency-domain signal generated in said ~~generating-step operation~~;
inverse-Fourier-transforming a signal obtained in said ~~multiplying-step operation~~ into an inverse-Fourier-transformed signal; and

calculating a correlation from a signal obtained in said inverse Fourier-transformed signal inverse-Fourier-transforming operation.

²⁴
~~30.~~ (Currently Amended) The OFDM demodulation method according to claim ²³~~28~~,
wherein

in said calculating ~~step operation~~, calculating an absolute value of a complex vector (i, q) of the incoming signal ~~is calculated~~.

²⁸
~~31.~~ (Currently Amended) The OFDM demodulation method according to claim ²⁷~~29~~,
wherein

in said calculating ~~step operation~~, calculating an absolute value of a complex vector (i, q) of the incoming signal ~~is calculated~~.

²⁵
~~32.~~ (Currently Amended) The OFDM demodulation method according to claim ²³~~28~~,
wherein

in said calculating ~~step operation~~, calculating a sum of an absolute value of i and an absolute value of q ~~is calculated from the~~ a complex vector (i, q) of the incoming signal.

²⁹
~~33.~~ (Currently Amended) The OFDM demodulation method according to claim ²⁷~~29~~,
wherein

in said calculating ~~step operation~~, calculating a sum of an absolute value of i and an absolute value of q ~~is calculated from the~~ a complex vector (i, q) of the incoming signal.

²⁶
~~34.~~ (Currently Amended) The OFDM demodulation method according to claim ²³~~28~~,
wherein

in said calculating ~~step operation~~, calculating a sum of a square of i and a square of q ~~is calculated from the~~ a complex vector (i, q) of the incoming signal.

³⁰
~~35~~. (Currently Amended) The method for OFDM demodulation according to claim ²⁷~~29~~,
wherein

in said calculating-~~step~~ operation, calculating a sum of a square of i and a square of q is calculated from the a complex vector (i, q) of the incoming signal.

¹⁹
~~36~~. (Withdrawn - Currently Amended) The OFDM demodulation method according to claim ¹⁸~~24~~, wherein

in said first determination-~~step~~ operation, a value for invariability of ~~said the~~ absolute value is detected, and then the absolute value showing a predetermined proportion to the invariable value is detected.

[Claims 37-42 (Canceled)

³¹
~~43~~. (Currently Amended) An OFDM demodulation apparatus for demodulating an OFDM signal which includes a specific synchronous symbol and an OFDM data symbol structured by a valid symbol period and a guard interval, ~~and said the~~ OFDM data symbol is being generated from a plurality of subcarriers, said apparatus comprising:

an impulse response estimator operable to estimate an impulse response from ~~said the~~ OFDM signal based on the synchronous symbol;

an integrator operable to integrate an output obtained by estimation in said impulse response estimator;

a determiner operable to detect symbol timing indicating a period where ~~said an~~ output obtained by integration in said integrator is maximum;

a window timing generator operable to generate, according to ~~said the~~ symbol timing, window timing including information which is capable of providing ~~said the~~ valid symbol period; and

a separator operable to separate ~~said the~~ OFDM signal into the plurality of subcarriers according to ~~said the~~ window timing.

³²
~~44~~. (Currently Amended) An OFDM demodulation method for demodulating an OFDM signal which includes a specific synchronous symbol and an OFDM data symbol

structured by a valid symbol period and a guard interval, ~~and said the~~ OFDM data symbol is being generated from a plurality of subcarriers, said method comprising:

an impulse response estimation-~~step~~ operation of estimating an impulse response from ~~said the~~ OFDM signal based on the synchronous symbol;

an integration-~~step~~ operation of integrating an output obtained by estimation in said impulse response estimation-~~step~~ operation;

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a determination-~~step~~ operation of detecting symbol timing indicating a period where ~~said an~~ output obtained by integration in said integration-~~step~~ operation is maximum;

a window timing generation-~~step~~ operation of generating, according to ~~said the~~ symbol timing, window timing including information which is capable of providing ~~said the~~ valid symbol period; and

a separation-~~step~~ operation of separating ~~said the~~ OFDM signal into ~~a the~~ plurality of subcarriers according to ~~said the~~ window timing.
